Saskatchewan

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Agriculture Development Fund

FINAL REPORT

HARVESTING METHOD AND ITS EFFECT ON RELATIVE FORAGE YIELDS

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Final Report

to

Agricultural Development Fund (ADF)

From

Saskatchewan Forage Council

For

Project # 97000234

Harvesting Method and its Effect on Relative Forage Yields

By: Randy Pastl M.Sc. P.Ag.

December 1999

1.0 1 ACKNOWLEDGEMENTS:

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1.0 2 ABSRACT:

Mechanical harvesting of forage trials often underestimates the yield of forage species with basal growth habit. For example, (meadow bromegrass and Russian wildrye). Most of the data collected on perennial forage yield is collected using a mechanical harvester because it is the most efficient method of harvesting a large number of small plots, and the primary goal is to estimate hay yield. We are limited in how close we can cut to the ground, and still estimate expected hav yield (5-6 inch stubble height is left). The result is a lower estimate of yield potential for many of our forage species that were primarily developed for grazing (species usually with many basal leaves). For carrying capacities and stocking rates to be as accurate as possible there must be correction factors developed to allow for adjustment of yields for species which are not reflected accurately in mechanical harvesting. It has been determined that the biomass of individual grass plants is not exclusively determined by height alone. Several factors related to growth form determine weight and these factors are modified by the environment (Caird, 1945; Clark, 1945). Wide row spacing can produce taller plants that are easier to harvest by machine than narrow rows (McGinnies, 1970; Leyshon et al. 198 1). Morphological variation between species also affects the proportion of biomass produced at varying levels in the crop canopy (Lodge et al. 1972). This is evident in Russian wildrye, where a large proportion of biomass is produced close to the ground due to its prostrate growth habit. Leyshon et al (1981), investigated the yield differences in Russian wildrye with harvesting method. Two harvesting methods were used; a flail type forage harvester and hand clippers. Results indicated that in 15cm rows, the machine harvested first cut left 74-93% of the dry matter yield harvested by hand. With 60 cm rows, the amount do dry matter remaining after the machine harvested first cut left 45-68% of the total harvested by hand. In summary, the machine left behind 33 -70% of the forage in narrow (15 cm) rows and 33-38% in the wide (60 cm) rows. The double sampling method consists of collecting two types of biomass data, one is clipped and the other is mechanical harvested.

The objectives of this project were to: provide baseline data on variety yields under conditions similar to animal harvesting methods; develop a relationship between clipped and machine harvested yields which will allow extension personal to better estimate initial stocking rates for many of our grazing species in Saskatchewan. Data was collected at Scott, Saskatchewan, using the established wheatgrass, wildrye grass and meadow bromegrass trials. A linear regression was then developed for each forage species tested by regressing total forage yield (clipped + machine harvested forage yield) on machine harvested forage yield. Total forage prediction equations were developed for Crested Wheatgrass (CWG), Smooth Brome (SB), Meadow Brome (MB), Intermediate Wheatgrass (IWG), Russian Wildrye(RWR), Altai Wildrye (AWR), Northern Wheatgrass (NWG), Western Wheatgrass (WWG), Streambank wheatgrass (SBWG) and Tall wheatgrass (TWG). These prediction equations can be used by forage extension agrologists to correct estimated yield data (mechanical harvested) for expected total forage yield. These equrations only predict the total forage to ground level. The forage agronomist must also subtract the % of forage carry-over that must be maintained to allow for plant regrowth and development. In addition, these regression equations are based on one year of data, at one

location and should be used with caution. It is recommended that more data be collected, with the inclusion of at least three site years of data and a number of locations. The following table gives a summary of the regression equations developed and the estimated accuracy of the equation.

Table #1. Regression equations developed from the data collected on Clipping versus Machine Harvested plots at Scott, Saskatchewan. 1999.

Species	Equation	Sig. Level (0.05)	Adjusted R-Squared
Smooth Brome Grass	Total Yield = 2658+0.937*Machine Harvested Yield	***	74%
Meadow Brome Grass	Total Yield =2701+1.08*Machine Harvested Yield	**	78%
Crested Wheatgrass	Total Yield = 2576+1.09*Machine Harvested Yield	***	89%
Intermediate Wheatgrass	Total Yield = 2285+1.01*Machine Harvested Yield	***	90%
Tall Wheatgrass	Total Yield = 353+1.93*Machine Harvested Yield	*	99%
Northern Wheatgrass	Total Yield = 3395+0.841*Machine Harvested Yield	ns	73%
Streambank Wheatgrass	Total Yield = 1058+1.67*Machine Harvested Yield	ns	4%
Western Wheatgrass	Total Yield = 4361+0.594*Machine Harvested Yield	ns	91%
Russian Wildrye	Total Yield = 2384+1.11*Machine Harvested Yield	***	93%
Altai Wildrye	Total Yield = 2928+0.912*Machine Harvested Yield	*	58%

Note: The above Prediction equations for the Predicted Forage Yield are based on one year and should be used with caution.

1.03 References:

Caird, R.W. 1945. Influence of site and grazing intensity on yield of grass forage in the Texas Panhandle.

Jour. Forestry. 43: 45-49.

Clarkj, I. 1945. Variability in growth characteristics of forage plants on summer ranges in central Utah.

Jour. Forestry. 43: 274-283.

Leyshon, A.J., Cutforth, H., Waddington, J. and Rymes, P.C. 1990. Effects or row spacing on biomass production and above ground harvestability of Russian Wildrye.

McGinnies, W.J. 1970. Effects of seeding rate and row spacing on establishment and yield of crested wheatgrass.

Agron. J. 62: 417-421.

1.0 4 PROJECT DESIGN:

A project to determine these correction factors will be carried out on one established site at Scott. The site contains 4'x 20'plots, replicated five times. The site includes meadow bromegrass, wheatgrass and wildrye grass trials with cultivars recommended for use in Saskatchewan. Each plot will have a one-quarter m2 areas hand clipped to grown level to simulate grazing. The biomass will be collected air dried at 60' C for 48 hours. The sample will then be weighted and the yield in Kg/ha (dry weight bases) will be calculated. The remainder of the plot will be harvested using a Swift Forage Plot harvester. A linear regression was developed to predict the total forage yield of the species tested. The independent variable for the prediction equation was the clipped yields versus the machine harvest yields. Harvesting was done once in early July (full head stage).

2.0 RESULTS:

2. 1 Bromegrass:

In 1999, Magna and Baylor smooth bromegrasss were the higher yielding varietes (table 1.). However, when the data is pooled over a five year period, Carlton yielded 12% and 17% greater than Magna and Baylor respectively. The differences between varieties within a species were not significantly different. However, in 1999, Magna significantly out-yielded Paddock and Regar meadow brome, but not Fleet meadow bromegrass. When we compare the precentage of clipped yield to harvested yield, the yield of Paddock and Regar meadow bromegrass was underestimated more by machine harvesting than all of smooth brome varieties tested, in 1999 (table 2.). There was no significant difference in yield between smooth brome and meadow brome when the clipped yield was added to the machine harvested yield. In addition, when the prediction equations were used to calcuated total forage yield, the overall means were very similar and once again their was no significant difference in expected forage yield between species. prediction equation for smooth bromegrass was: Total Yield = 2658+0.937*Machine harvested yield. The regression equation was significant with an adjusted R-Squared of 74% (table 2.). The regression equation for meadow bromgrass was: Total yield = 2701+1.08*Machine harvested yield. The regression equation was highly significant with an adjusted R-Squared of 78%.

2. 2 Wheatgrass:

In 1999, Summit crested wheatgrass out-yielded all other wheatgrass varieties tested except Parkway and Chief (table 3.). Chief, Summit, and Parkway yielded 121, 113 and 106% of Kirk when yields were averaged over five years. A look at the amount of forage left after machine indicates that Greenleaf intermediate wheatgrass was the most harvesting the plots, underestimated wheatgrass speices. Clipped yield was 153% of the machine harvested yield (table 4.). The next most underestimated wheatgrasses were Kirk at 133 and Clark at 118%. It is interesting to note that the two highest yielding wheatgrasses, hief and Summit, were also the least underestimated of all the wheatgrasses tested. However, 1999 at Scott, the combined yield (clipped + Mahine harvested) of Summit was significantly higher than all other wheatgrasses except Parkway and Chief (table 4). The prediction equations for crested and intermediate wheatgrass were highly significant, with an adjusted R-squared of 89 and 90% respectively. In additon, the regression equation for Tall wheatgrass was significant and had an adjusted Rsquared of 99%. However, the regression equations for Northern, Streambank and Western wheatgrass were not significant (table 4.). When the regression equations were developed, the data from varieties within a species was pooled to give a better prediciton of yield and to reduce However, streambank, western wheatgrass, tall wheatgrass and northern wheatgrass were represented by only one variety and the data could not be pooled. As a result, we had limited data from which to develop the regression equations. It is suggested that more data be collected on these forage species in order to develop better equations.

2. 3 Wildrye grasss:

In 1999, Mayak wildrye outyielded all other wildryes except Swift (table 5.). Mayak yielded 114% of Swift when the data was averaged over five years. In 1999, the clipped yield of Pearl, Eejay and Prairieland was 122, 113 and 85 % of the machine harvested yield, respectively (table 6.). The reqression equation for Russian wildrye was highly significant with an adjusted R-squared of 93%. In addition, the reqression equation for Altai wildrye was significant and had an adjusted R-squared of 58%.

2.4 Combined Forage Yield:

Over all, when the forage yields obtained are averaged over the five years, Carlton smooth bromegrass outyielded all other forage varieties by greater than 7% (table 7.).

3.0 CONLCUSION

The results indicate that at Scott, is was possible to develop regression equations for each species to accurately predict total forage yield to correct forage species that are machine harvested. The results of the this study are similar to those obtained by other researchers. However, these regression equations are based on only one site-year of data and must be used with caution.

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1993 Brane Valety Adaptation Test

Table 2. 1

Saaft, SK

	1994	1995	1996	1997	1999		5 Year Average
Valety	Told	Total	Told	Total	Total		
	Forgs	Fagge	Forgs	Fagge	Forge	Forage	8
	Yield	Yield	Vield	Medd	Yield	Yield	Conflor
	(AgDWha)	(AgDWhd)	(AgDWha)	(ADM/ma)	(AgDWha)	(kgDM/kg)	
Signal smooth	8313	2475	7344	5673	3397	5440	26
Magrasmodin	8448	2453	7899	4178	4126	5158	87
Poddock meodow	7762	2710	7413	5004	2866	5149	87
Rebandsmooth	0889	2640	7173	2999	3241	5039	*8
Bayla smadh	7116	2204	7017	4393	3875	4921	88
Fleet meadby	7308	2705	6118	3946	3489	4713	8
Regar meadow	6403	2208	5804	3739	2942	4219	17
Mean	7638	2554	6933	4853	3410	5078	
CV. (%)	=	18	14	21	13		
(SD/QS)	8	20	1204	1348	8		

Table 2.2

1993 Brame Variety Addadion Test

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C	5	
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		8	1999 Forgos Yield (Hand-Olipping versus Mathine Harvesting)	Adipping	versus Machin	De Harvesting	
Voriety	Olimed	Martine Havested (Clipping + Machine	Predded	Clippedos %	Clippedos %	Olpada %
	Forms	Forms	Forge	Force	of Harvested	ofTotal	of Predded
	Vield	Med	Med	Yield	Forage	Forge	Fagge
	Acolomo	MadMind	ACIDAMO	MadMhd	Yield	Med	Yield
					8	36	88
Portbok meadow	3159	2865	6013	5784	111	83	28
Recor mental	2889	2942	5831	5878	201	8	8
Fleet meadow	2779	3489	8929	6989	88	\$	43
Signal smoth	2394	3397	16/5	5841	76	4	40
Refordsmoth	2372	3241	5612	2999	74	4	40
Boyla smath	2794	3875	6999	6289	73	40	45
			195	2532	(6)		
Marasmath	2404	4126	6631	6525	88	37	37
Mech	2624	3410	6034	9009			
CV. (%)	13	13	01	00			
(SD(0,05)	288	82	ع	٩			
Note: The Predict	on equation	Note: The Prediction equation for the Predicted Forces Vield	rage Vield	Sign	Significance level (0.05)	(0.05)	Adjusted R-Squared
Smoon blone	Ad Feed	Smooth bigging 1 day 2 day 2 months in 100 Martine House Long 1 and 1 day 2 da	Ambino Honerton	Made	i		78%
MECLEW BIGHTS I GG FG	ad radio	March Idne do rate 100 110 1	INTERIOR NAMED			and the state of	and with on the

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1993 Brane Vaiety Adaddian Test

Scott, SK

	1994	1995	1996	1997	1999		5 Year Average
Vaiety	Total	Totd	Total	Total	Total		
	Fage	Fage	Forge	Faage	Fage	Fame	%
	Yield	Vield	Yield	Vield	Yield	Yield	Corton
	(kgDMhd)	(kg DM/hc)	(kg DIMha)	(kg DMha)	(kgDMhd)	(kg DMhd)	}
Carlfon smooth	9/88	3033	8013	6331	3356	5972	100
Signal smadh	8313	2475	7344	5673	3397	5440	8
Magnasmadh	8448	2453	6582	4178	4126	5158	87
Poddock meadow	7762	2710	7413	5004	2855	5149	87
Rebandsmath	0889	2640	7173	2560	3241	6605	88
Bayla smadh	7116	2204	7017	4393	3875	4921	88
Fleet meadow	7308	2705	6118	3946	3489	4713	8
Regar meadow	6403	2208	5804	3739	2942	4219	77
Mean	7638	2554	6933	4853	3410	5078	
CV. %)	=	18	14	21	13		
LSD (0.05)	8	ع	1224	1348	780		

1993 Brane Variety Adaptation Test

		861	1999 Forage Yield (Hand-Clipping versus Machine Havestling)	nd-Gipping	versus Machir	ne Harvesting)	
Vaiety	Oipped	Machine Havested (Clipping + Machine	Predded	Clippedcs %	Clippedcs %	Clippedcs %
	Farage	Farage	Fage	Fage	of Havested	ofTotal	of Predded
	Yield	Yield	Yield	Yield	Forage	Forge	Forge
	(ka DM/ha)	(kg DM/hg)	(kg DMha)	(kg DMhd	Yield	Yield	Vield
					%	%	%
Pootbook meodbw	3159	2855	6013	5784	111	53	22
Rear meadow	2889	2942	5831	5878	102	9	9
Fleet meadow	2779	3489	6268	6469	83	45	43
Signd smooth	2394	3397	1673	5841	76	42	42
Rebandsmath	2372	3241	5612	2898	74	42	42
Baylar smadh	2794	3875	6999	6586	73	42	45
Carlton smooth	2200	3356	9999	5803	19	9	88
Magrasmadh	2404	4126	6631	6525	58	37	37
Macn	2624	3410	6034	6035			
CV. (%)	13	13	10	00			
LSD (0.05)	282	790	ع	92			
tota The Praddi	on equation	Note The Prediction equation for the Predicted Faces Vield	rage Yield	Signi	Significance level (0.05)	(90.05)	Adjusted R-Squared
Aparton Brome L	of Forms	Marria Brans Late Forms Vide - 2701 + 1 08 - Marrian Harvestad Vide	Verhine Horvested	Vield	:		78%



1993 Whedgas Vaiety Addaion Test Scatt, SK

	1994	1995	1996	1997	1999	5 %	5 year average
Voietv	Tota		Total	Total	QT#1	Total	
	Forme		Forme	Faage	Fage	Fage	8%
	Yield		Yield	Yield	Yield	Yield	Kirk
	(kg DM/hd)	(kg DMnd)	(kg DM/hd)	(kg DMhd)	(kg DMhd)	(kgDMhd)	
Trief infermed de	6896	3298	5279	4640	4648	5503	121
i mmit greated	0999	2605	6327	4878	5306	5135	113
Parkary gested	5054	2997	6479	5367	41%	4819	106
Tel restar	9009	3220	6999	4469	2369	4563	92
Ampled intermedde	9013	2613	5226	3722	1881	4491	88
Jakeinfermedde	9153	2606	4480	4011	2001	4450	86
Forwarded	4946	2566	2909	4770	3442	4358	8
Virgin meted	5534	2581	6266	4264	3045	4338	8
Fibenathen	4865	1028	4034	2430	3249	3121	89
Objected	5364	2080	3764	2102	1792	3022	8
Sortrestreambrak	4046	198	4123	2320	2890	2729	9
Mdsh western	3628	069	3319	1690	3121	2490	55
Magn	6168	2263	5159	3722	3111	4085	
8 > > >	12	16	12	27	26		
SOURS	8	459	777	1300	1393		

1993 Whedgas Valely Adptalon Test Scatt, SK

	1994	1995	1996	1997	1999	54	5 year overage
Valety	Told	Told	Told	Tota	GT#1	Told	
	Forge	Fagge	Fagge	Fagge	Forge	Forge	88
	Yield	Med	Yield	Vield	Yield	Yield	Klrk
	(Ag CIMPO)	(kgCM/rd)	(kgDWhd)	(kgCMhd)	(kgDMhd)	(kg[JMhq)	
Chef intermedde	0450	3298	6009	4640	4648	5503	121
Summit dested	0999	3605	6327	4878	5306	5135	113
Parkway arested	5064	2997	6479	5367	41%	4819	106
Geerled Intermedde	9013	2613	9779	3722	1881	1657	86
Cakeintermedde	9153	3606	4480	4011	2007	4450	89
drway greated	4946	2566	2909	0/14	3442	4358	8
Nordon prested	5534	2581	9989	4264	3045	4338	8
Elbenothen	4866	1028	4034	2430	3249	3121	98
Outd	5364	2089	3764	2012	1792	3022	8
Soch streambark	4046	298	4123	2320	280	2729	8
Wdsh western	3628	069	3319	1690	3121	2490	83
Mean	8919	2263	5159	3722	3111	4085	
CV. (%)	12	16	12	22	8		
SDOODS	98	489	111	1300	1393		

1993 Whedgas Valety Adpaian Test Satt, SK

		1999 F	1999 Foratse Yield (Hand-Clipping versus Machine Harvestling)	Clipping ve	rsus Machine	-farvesting)	
Veriety	Oimed	Machine Havested	Qimina+Mathine	Predded	Clippedcs %	Clipped & %	Clipped G %
(5)	Forme	Forme	Forme	Forme	of Havested	ofTold	of Predded
	Vield	Vield	Yidd	Yield	Fage	Fagge	Forge
	AND MAN	MODWING	MadMy	Radowna	Yield	Yield	Vield
	1	1			86	26	36
Gearled Intermedde	21%	1881	4076	4184	153	22	25
		1000	317			25	41
Ocheinfermedde	2263	2001	4264	4306	118	22	83
Widshwestern	3063	3121	6214	1609	711	51	25
Sortrettentonk	2897	2290	4887	4882	114	53	S
Opti	2018	1792	3811	3812	113	B	B
North greated	3070	3045	6115	2885	20	51	83
Fibenothen	2878	3249	6127	6127	8	88	48
Folyan greated	2824	3442	6266	6328	88	45	45
Porkov dested	3287	4196	7483	7150	2	4	94
Chief infermed de	2505	4648	7153	0869	88	38	8
Summit dested	2601	2306	7007	8360	48	33	31
Mean	2677	3111	5789	5773			
CV. 83	17	36	16	14			
ISDAOO	2	1393	1594	1339			
Prediction	equation for	n equation for the Predicted Forage Yield	pa Yield	Sign	Significance Level (0.05)	(0.05)	Adjusted R-Squared
Oceted Whedgrass	Told Yield=	Total Yield = 2576 + 1.09 * Machine Harvested Yield	ne Harvested Yield		•		%68
	Mos Told V	ald = 2285 + 1.01 "M	xhine Havested Y	ield	•		%06
Northern Wherlorgs	Total Viela	ts Total Vield = 3395+0.841 "Morbine Harvested Yield	ne Harvested Yield		22		73%
Toll Wheelergs Tolc	Wed=35	tol Vield = 353+1 937Mttchine Harvested Vield	ested Yield				100%
Strentonk Wheateness Total Vield = 1058+1.67 Machine Havested Yield	oss Total Vi	ald= 1058+1.67*Mc	hine Harvested Yie	P	22		4%
Western Whosteres Total Vidid - 4341.0 5947 Arrhine Hovested Vidid	Total Vield	- 4341 JO 5947 Marchin	a Howested Yield		2		%16
the state of the branches for the Branches France Vide crabband on only one way and should be used with carlifon	della en	tione for the Bradich	ad Forma Vididos	ahosadon	pay one vinc	adbludsbu	used with countion.
NOE - BCCCOALIO		38-5-5-65	The state of the s		The same of the sa		

1993 Wildye Vaiety Adaptaian Test Saatt, SK

	1994	1995	9661	1661	1999	5	5 year average
Vaiety	Total	Total	Total	Total	Total	Havested	
	Fame	Forge	Forage	Farage	Forge	Fage	8
	Yield	Yield	Yield	Yield	VIEW	Yield	SWIT
	(kgDMhd)	(AgDM/rd)	(kgDWhd)	(kgDM/rd)	(kg DMhd)	(kgDMhd)	
Maydkrussian	2522	3696	6909	2996	7370	4531	114
Tetrasian	2191	3118	5614	2906	5638	3893	86
Careerussion	2049	3214	6354	2389	4943	3790	8
Pearl dtd	2873	3138	5615	1916	2336	3155	2
Prairieandalta	2835	3018	4512	2256	3097	3144	2
Eejay alta	2827	3013	4400	1868	2432	2928	73
Mean	2534	3291	5273	2532	4535	3633	
CV. (%)	01	12	14	8	15		
(8D/009)	323	605	986	8999	1590		

Valey	l		1777 Folder Held (Hand-Clipping versus Machine Harvesting)	alipping ve	rsus Machine	dryesting	
	Qidased 1	Machine Havested	Clipping + Machine	Predded	Climedes %	Climana %	O morrow O
	Forge	Force		Forms	A Hayara	o order	% sopardin
	VP!X	77.5	7 7 7	3	BIBARIA	ppla	d Predded
	200	DAL	VIBO	Yied	Farage	Fagge	Forme
3	(kg LIVING)	(kg LIMPO)	(kg DMha)	(kg DMhd)	Yield	Yield	Yield
					%	%	9%
dened internedate	21%	1881	4076	4184	153	2	27
Kirk arested	2794	07.6	1715	CTEO	133	5 2	3
Oakeintermedate	2263	iouc	300	2010	3	8	18
	2000	1002	4704	4306	118	2	53
Washweigh	3093	3121	6214	2609	117	51	2
Sood Streamank	2597	2290	4887	4882	114	53	53
Capital	2018	1792	3811	3812	113	23	3 2
Nardan greated	3070	3045	6115	5805	2 2	3 5	3 8
Elbænarhan	2878	3200	5177	4107	3 8	5	3
Forwayareted	2804	3440	1310	1710	3	84	48
	2024	242	0070	6328	88	45	45
Carmy Caled	328/	814	7483	7150	29	4	46
Cie memedde	2505	4648	7153	0869	55	35	3%
Summirgested	2601	5306	7907	8360	48	33	3 8
Mean	2677	3111	5789	5773			
CV. (%)	17	26	16	14			
LSD (0.05)	2	1393		1339			
	dion for #	ne Predicted Forces	9 Yield	Signif	Significance Level (0.05)		Adjusted R-Sourced
Created Whedgras Total	Yield=2	old Yield = 2576 + 1.09 * Machine Harvested Yield	e Harvested Yield				%68
niermedide Whedigras Told Yield = 2285 + 1.01 "Machine Havested Yield	Total Yield	J= 2285 + 1.01 "Max	thine Harvested Yiel	P	:		%06
	d Yield=	3395+0.841 "Marchin	e Harvested Yield		SU		73%
al wheagas I ofal Yie	Id = 353+1	Yield = 353+1.93*Machine Harvested Yield	sted Yield				100%
	ord Yield	= 1058+1.67*Machi	ine Harvested Yield		SU		4%
Western wheadards I are	Yield=4	ord Yield = 4361+0.594*Machine Harvested Yield	and yield = 4361+0.594*Watchine Harvested Yield ns		SU		%16

1993 Wildye Vaiety Addaion Test Saatt, SK

	1994	1995	1996	1997	1999	5	5 year average
Vaiety	Told	Told	Total	Total	Total	Havested	
	Fage	Fage	Farage	Forge	Farage	Fage	84
	Yield	Yield	Yidd	Yield	Vield	Yield	SWift
	(kg DM/hd)	(kgDM/hd)	(kg DIMha)	(kg DM/hd)	(kg DMhd)	(kg DM/hd)	
Maydk russian	2522	3696	6909	2996	7370	4531	114
Swift russion	2340	3841	4444	3390	9930	3989	100
Teframrussian	2191	3118	5614	2906	5638	3893	86
Cobreerussion	2049	3214	6354	2389	4943	3790	8
Pearl dtai	2873	3138	5615	1916	2336	3155	79
Prairieandata	2835	3018	4512	2256	3097	3144	79
Egay dta	2927	3013	4400	1868	2432	2928	73
Mean	2534	3291	5273	2532	4535	3633	
CV. (%)	01	12	14	8	15		
LSD (0.06)	323	609	096	8999	1590		

Table 2. 6

1993 Wildye Variety Adaptation Test Scott, SK

			1999 Forage Yield (Hand-Clipping versus Machine Havesting)	and Clipping w	arsus Machine Ho	rvesting	
Vaiety	Clipped	Machine Havestec	Matrine Havested Clipping + Matrine	Predded	Clippedas %	Clippedas %	Clippeda %
	Farage	Fage	Forge	Forage	of Havested	of Total	of Predded
	Yield	Vield	Vidd	Yield	Forme	Forme	Forme
	(kg DMhd)	(kgDIMhd)	(kg DM/hg)	(kgDMhd)	Yield	Yield	Vield
					%	%	8
Pearl dtd	2764	2336	5100	6909	122	28	55
Egay atta	2750	2432	5182	5146	113	23	53
Prairielandata	2581	3097	5678	5752	88	45	45
Cobreerussion	2814	4943	7277	7871	19	37	37
Swiff russion	3137	5930	2906	8967	SS	38	32
Maydk russion	3425	7370	107%	10664	49	32	33
Tetramrussian	2723	5638	8361	8642	49	33	32
Mean	2885	4535	7420	7429			
CV. (%)	10	15	13	13			
LSD (0.05)	2	1590	1770	1730			
Note: The Predic	dion equali	Note The Prediction equation for the Predicted Forces Yield	1Forage Yield	Sig	Significance Level (0.05)	(90)	Adjusted R-Sougred
Russian Wildrye	Grass Tota	I Forage Yield = 23	Russian Wildye Gras I old Farage Yield = 2384+1.11 "Machine Harvested Yield	/ested Yield	:		93%
Alta Wildrye Gras Told F	as Total Fo	YCTB Yield = 2928+	Forces Yield = 2928+0.912*Wachine Harvested Yield	ted Yield			28%
Note The charge	Dronfolim	overstione for the D	When The strains Breatains for the Breatains for the Breatains and a second sec	I as bread on	and a contract of the	International State of the land	1

udiats for interredated radge fried are bosed on only one year and should be used with courion.

Table 2.7

Corrbined Forage Yield of all Grasss Species at Scott, SK

Plots were sown in 1993

	1001	100%		vere sown in 19		T .	
	1994	1995	1996	1997	1999		ear average
Variety	Total Forage Yield (kg DM/ha)	Harvested Forage Yield (kg DM/ha)	% of Carlton Smooth Brone				
Paddock meadow	7762	2710	7413	5004	2855	5149	87
Carlton smooth	8876	3033	8013	6331	3356	5922	100
Summit crested	6560	2605	6327	4878	4648	5004	84
Fleet meadow	7308	2705	6118	3946	3489	4713	80
Signal smooth	8313	2475	7344	5673	3397	5440	92
Parkway crested	5054	2997	6479	5367	3442	4668	79
Magna smooth	8448	2453	6582	4178	4126	5158	87
Rebound smooth	6880	2640	7173	5560	3241	5099	86
Kirk crested	6206	3220	6549	4469	1792	4147	75
Mayak russian	2522	3696	6069	2996	7370	4531	77
Nordan crested	5534	2581	6266	4264	3045	4338	73
Chief intermediate	9649	3298	5279	4640	1881	4949	84
Baylor smooth	7116	2204	7017	4393	3875	4921	83
Regar meadow	6403	2208	5804	3739	2942	4219	71
Fairway crested	4946	2566	6067	4770	3121	4294	73
Greenleaf intermediat	9013	2613	5226	3722	2290	4573	77
Clarke intermediate	9153	2606	4480	4011	2369	4524	76
Swift russion	2340	3841	4444	3390	5930	3999	67
Orbit tall	5364	2089	3764	2102	3249	3313	56
Tetracan russian	2191	3118	5614	2906	5638	3893	66
Cabree russian	2049	3214	6354	2389	4943	3790	61
Sodar streambank	4046	867	4123	2320	4196	3110	53
Walsh western	3628	690	3319	1690	5306	2927	40
Elbee northern	4865	1028	4034	2430	2001	2872	48
Peat attai	2873	3138	5515	1916	2336	3155	53
Prairieland altai	2835	3018	4512	2256	3097	3144	53
Eejay altai	2927	3013	4400	1868	2432	2928	49

1993 Wildye Vaiety Addadion Test Scaft, SK

Table 2. 6

			WILLIAM THE THE WASHINGTON WITH BUT AND INC.			TANIE TO	
Valety	Olpas	Machine Havester	Matrine Havested Clipping + Matrine	Predded	Clippedas %	Clippedcs %	Clippedos %
	Forge	Fagge	Forge	Fagge	of Havested	ofTotal	of Predded
	Medd	Med	Meld	Yield	Forme	Forms	Forme
	(ADDAMA)	(AgDMr.	(AgDWha)	(ADDMIN)	Med	Vield	Vield
					36	36	%
Peal alla	2764	2336	5100	6909	122	28	83
Eglay dtd	2750	2432	5182	5146	113	83	83
Prairieandata	2881	3097	8298	5752	88	45	45
Odreenssion	2814	4943	7757	7871	19	37	37
Maydk russion	3255	7370	10795	10564	607	32	33
Tetramnesion	2723	5638	8361	8642	49	33	8
Mean	2885	4535	020/	7429			
CV. (%)	9	15	13	13			
LSD (0.05)	2	1590	02/1	1730			
Note The Predic	flon equality	Note The Prediction equation for the Predicted Forage Yield	dForage Yield	Sig	Significance Level (0.05)	(90)	Adjusted R-Squared
Russian Wildrye Grass To	Grass Tolo	Forga Yield= 23	td Forces Yield = 238441.11 "Mathine Harvested Yield	ested Yield			93%
Alld Wildre Gras Told		ross Meld=29284	Grass Yield = 2928+0.912*Wathing Havested Yield	ted Yield			2005

Table 2.7

Combined Forage Yield of all Grasss Species at Scott, SK

Plots were sown in 1993

				were sown in 1			
	1994	1995	1996	1997	1999		ear average
Variety	Total Forage Yield	Total Forage Yield	Total Forage Yield	Total Forage Yield	Total Forage Yield	Harvested Forage Yield	% of Carlton
	(kg DM/ha)	Smooth Brome					
Paddock meadow	7762	2710	7413	5004	2855	5149	87
							111
Summit crested	6560	2605	6327	4878	4648	5004	84
Fleet meadow	7308	2705	6118	3946	3489	4713	80
Signal smooth	8313	2475	7344	5673	3397	5440	92
Parkway crested	5054	2997	6479	5367	3442	4668	79
Magna smooth	8448	2453	6582	4178	4126	5158	87
Rebound smooth	6880	2640	7173	5560	3241	5099	86
Kirk crested	6206	3220	6549	4469	1792	4447	75
Mayak russian	2522	3696	6069	2996	7370	4531	77
Nordan crested	5534	2581	6266	4264	3045	4338	73
Chief intermediate	9649	3298	5279	4640	1881	4949	84
Baylor smooth	7116	2204	7017	4393	3875	4921	83
Regar meadow	6403	2208	5804	3739	2942	4219	71
Fairway crested	4946	2566	6067	4770	3121	4294	73
Greenleaf intermediat	9013	2613	5226	3722	2290	4573	77
Clarke intermediate	9153	2606	4480	4011	2369	4524	76
Swift russion	2340	3841	4444	3390	5930	3989	67
Orbit tall	5364	2089	3764	2102	3249	3313	56
Tetracan russian	2191	3118	5614	2906	5638	3993	66
Orbree russian	2049	3214	6354	2389	4943	3790	64
Sodar streambank	4046	867	4123	2320	4196	3110	53
Walsh western	3628	690	3319	1690	5306	2927	49
Elbee northern	4865	1028	4034	2430	2001	2872	48
Peat dtd	2873	3138	5515	1916	2336	3155	53
Prairieland altai	2835	3018	4512	2256	3097	3144	53
Bejay altai	2927	3013	4400	1868	2432	2928	49

Scott Weather Data from 1991 to 1999

Mean Monthly Temperature ^oC

	Jan	8	Mer	Apr	May	ry.	July	Aug	tag S	ğ	2	28	
					í			۱		ı	ı		
1991	-15.1	φ	-52	560	10.90	1540	17.40	8	10.70	-0.6	-82	-11.3	
1982	-95	-9.4	92	4.40	9.80	14.60	15.50	14.40	830	Σ	-38	-189	
1983	-182	14.7	35	4.10	11.20	1320	14	14.90	9.30	340	8.5	66	
1994	-19.4	-21.6	4	4.20	10.90	5	17.10	16	1340	43	82	-138	
1985	-14.3	-11.3	84	1.10	10.40	16.50	16.80	14.80	11.50	350	-10.3	-169	
1896	-235	-134	=======================================	330	R.7	15.20	17.20	17.30	9.40	8	-126	-183	
1991	-203	-10.9	84	1.80	83	16.50	17.80	17.80	13.30	330	Ž	Z	
1980	4-	9-	4	w	o	13.5	15	16.8	95	4	7	Z	
Total Precipita	tion												
(IIII)													
	ug.	B	ME	A	May	Z	Sel.	A	B	8	3	8	Total
1845			11.5	11.50	× 3.0	(5,41)	(DEAL)	44.5.6.37	43569	1 (202)	115.83	1 17 6.2.8	455553
1991	1240	15.80	978	2230	33	111.10	18.90	41.30	9	48.80	690	10.60	336.70
980	223	16.20	89,	17	31.90	10.90	164.40	3.20	51.70	Σ	8	23.40	904
1993	380	250	17.40	4.50	21.60	100.60	8250	3860	24.90	10.50	2080	200	377.50
188 188	37.30	21.80	9	360	228	55.10	6020	7250	380	8	7.60	9.50	8
1995	850	640	19.30	1290	29.90	37.50	38.90	88	55	15.90	29.10	17	309.90
1996	1280	4.80	340	18.40	4360	63.80	11640	37.10	49.30	1380	31.30	20.50	415.20
1987	830	8	980	1520	8	6820	38.20	29.80	50.60	16.80	×	×	249.10
1980	83	97	10.6	83	884	428	200	47.6	58	2	54	N	388.4



Scott Weather Data from 1991 to 1999

Mean Monthly Temperature "C

	Jan	8	Mar	B	May	5	July	Aug	THE SE	8	3	280	
moy :	-17.9	-137	4	9	10.20	4	17.10	16	2	33	-6.2	-143	
1991	-151	sp.	-5.2	5.60	10.90	15.40	17.40	8	10.70	-0.6	-82	-11.3	
1982	-9.2	-9.4	0.5	4.40	9.80	14.60	15.50	14.40	8.90	Σ	-38	-18.9	
1980	-18.2	14.7	-35	4.10	11.8	13.20	14	14.90	9.30	340	8.5	6.6	
1984	-19.4	-21.6	4.7	4.20	10.90	15	17.10	16	13.40	4.30	6.2	-13.8	
1995	-14.3	-11.3	64	1.10	10.40	16.50	16.80	14.80	11.50	350	-10.3	-16.9	
1996	-235	-134	-1.1	320	2.7	15.20	17.20	17.30	9.40	1.90	-126	-18.3	
1997	-203	-10.9	-8.4	1.80	2.6	16.50	17.80	17.80	13.30	330	×	Z	
1989	-17	9-	4	S	6	13.5	15	16.8	9.5	44	-1.1	X	
Total Precipita	tion												
(ELL)													
	FEZ.	- FE	Mar	A	May	5	July	Aug	3	8	3	80	Total
E S	16.30	1270	16.30	2250	36.30	61.30	27.19	46.20	3030	16.80	15.60	17.80	353.80
1991	1240	15.80	8.6	2230	8	111.10	18.90	41.30	9	48.80	6.90	10.60	336.70
1992	23.73	16.20	4.60	17	31.90	10.90	164.40	31.20	51.70	Σ	8	23.40	405
1983	390	250	17.40	44.50	21.60	100.60	8250	38.60	24.90	10.50	20.80	26	377.50
1994	37.30	21.80	0.40	360	54.8	55.10	60.20	7250	380	88	7.60	9.50	88
1996	8.50	6.40	19.30	1290	89.80	37.50	38.90	88	5.5	15.90	29.10	17	309.90
1996	1280	4.80	340	18.40	43.60	63.80	116.40	37.10	49.30	13.80	31.30	20.50	415.20
1997	8.20	83	9.80	15.20	83	68.20	36.20	29.80	50.60	16.80	X	×	249.10
1980	83	0.8	106	83	66.4	42.8	2	476	28	2	54	MA	755.